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Conservation In Practice

# Building a global-oriented ecological civilization: Huzhou's actions and practice, China

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## Abstract

Biodiversity, ecosystems and the services they provide are crucial to the sustainable development of cities, the health and well-being of residents and the maintenance of urban ecological security. The continued decline of global species biodiversity and ecosystem service function has seriously affected the sustainable development of regional social economy. The core of ecological civilization thought is sustainable development, and promoting sustainable development is also the path and means to achieve ecological civilization. As the significant birthplace of ecological civilization thought of "Lucid waters and lush mountains are invaluable assets", Huzhou has always been committed to creating an "important window" for building an ecological civilization and actively integrating biodiversity conservation into ecological conservation. Through unremitting efforts in recent decades, Huzhou has successfully achieved green sustainable development and reversed the trend of biodiversity loss. Thus, there is a need for a systematic review of successful initiatives in this region and identify the experiences and methods that can advance the sustainable development also in other parts of the world.

**Key words:** Biodiversity conservation, ecological civilization, Huzhou City, sustainability, sustainable development goals (SDGs)

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## Introduction

The second phase of the 15th Conference of the Parties to the United Nations Convention on Biological Diversity (CBD COP15) was held in Montreal, Canada from December 7 to December 19, 2022. During the conference, Huzhou City, in Zhejiang Province, Eastern China (Fig. 1), not only won the title of the world's only "International Cooperation Demonstration Zone of Ecological Civilization" (State Council of the People's Republic of China 2022a, b) but also was recognized as "the Charming City of Biodiversity" and "the Natural Urban Platform". As the significant birthplace of ecological civilization thought of "Lucid waters and lush mountains are invaluable assets" (Zhai et al. 2019), Huzhou has always been committed to creating an "important window" for building an ecological civilization and actively integrating biodiversity conservation into ecological conservation. At the same time, Huzhou has been striving to achieve

the goal of green and sustainable development and promoting the harmonious coexistence between human and nature. Therefore, it can be said that Huzhou has provided an action plan and practical experience for the world to realize the coordinated development of economy, society and ecological environment.

Biodiversity, ecosystems and the services they provide are crucial to the sustainable development of cities, the health and well-being of residents and the maintenance of urban ecological security (Naeem et al. 2012; Folke et al. 2016; Wood et al. 2018). Now, more than 50% of the world's population lives in urban areas (Benz et al. 2021), and rapid urbanization will lead to the loss and fragmentation of natural habitat to a certain extent (Li et al. 2022; Aguilera and González 2023), thus aggravating the risk of biodiversity loss and ecosystem degradation, which will pose a major threat to human survival and development (Cobbinah et al. 2015; Henle et al. 2016; Gao and Zhang 2020). As one of the world's most biologically diverse countries (Liu et al. 2013), China has formulated a national strategy and action plan for biodiversity conservation in the new era, included biodiversity conservation plans in important economic and social development plans, and integrated biodiversity conservation with the whole process of ecological civilization. At present, many cities in China are developing an ecological civilization and have achieved a certain degree of effectiveness. For example, in addition to Huzhou, there are five cities in China (Kunming, Yunnan Province; Chengdu, Sichuan Province; Nanyang, Henan Province; Jiaxing, Zhejiang Province; Shenzhen, Guangdong Province) that have won the title of "Biodiversity Charming City". It is reported that the selection for the honor took the Singapore Index on Cities' Biodiversity into consideration, recommended by the Secretariat of the Convention on Biological Diversity. However, the effectiveness of biodiversity conservation and sustainable development combined with building an ecological civilization is still not fully summarized and discussed.

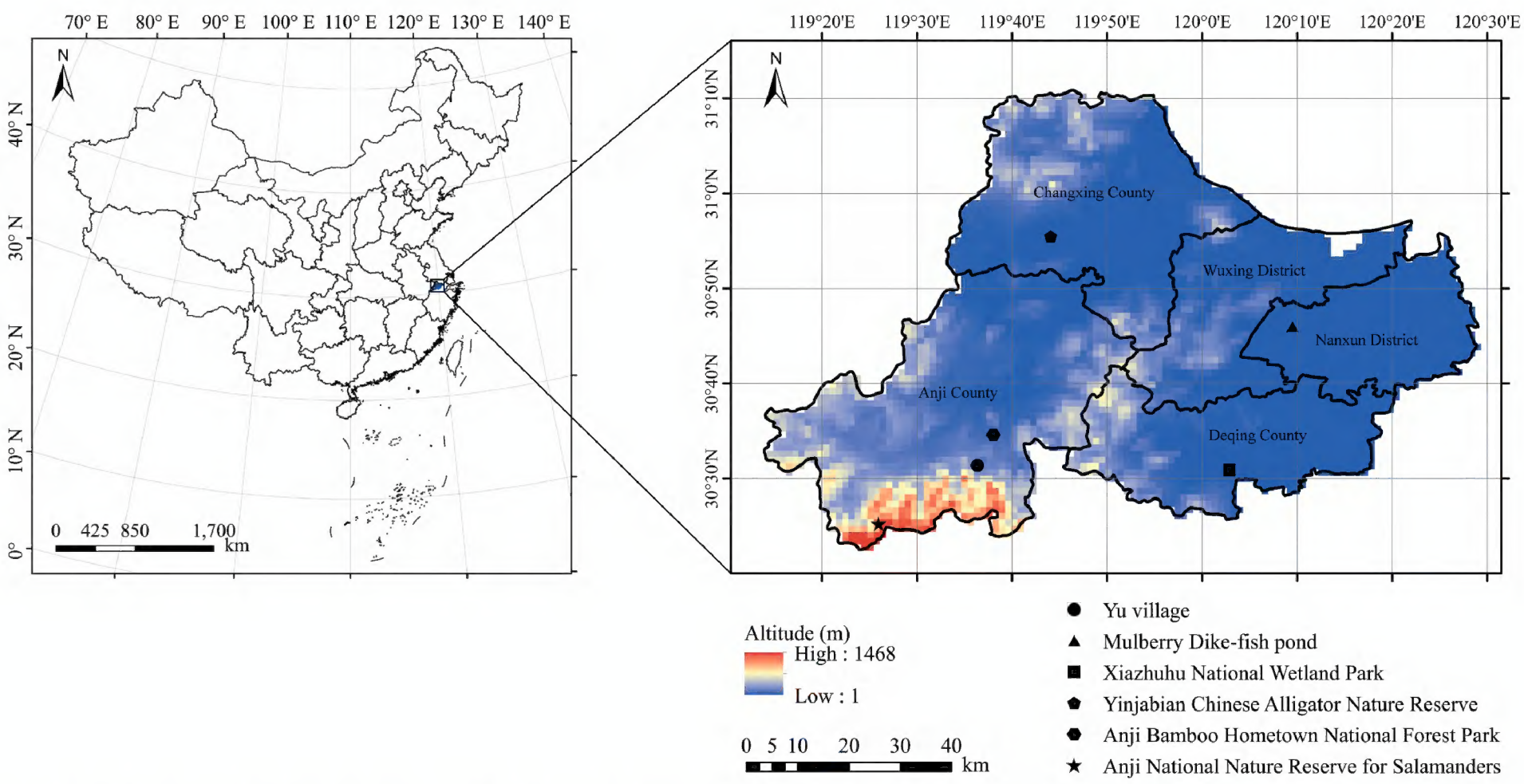


**Figure 1.** Location of the study area. (Left) Huzhou is located in the eastern part of China. (Right) The administrative divisions of Huzhou and the distribution location of typical cases of ecological civilization (the location of the center point).

For Huzhou, its 5820 km$^2$ of land is home to 3.41 million permanent residents (by the end of 2022). In fact, nighttime lighting data can be a good indicator of the level of urbanization and intensity of anthropogenic activities. According to the annual data distribution of nighttime lighting (Fig. 2), the urbanization process in Huzhou has been accelerating in the last decade (Pan et al. 2015). However, Huzhou has still made remarkable achievements in building an ecological civilization and biodiversity conservation (Huzhou People's Government 2022a). Therefore, it is essential to summarize and analyze the typical cases and achievements of Huzhou in promoting ecological civilization and biodiversity conservation in recent years. Meanwhile, it is of great significance to put forward how Huzhou should further promote ecological civilization and deepen international exchanges and cooperation in the new period, so as to leverage Huzhou's strengths and pilot experiences in realizing the 2030 goals of global biodiversity conservation and global sustainable development.

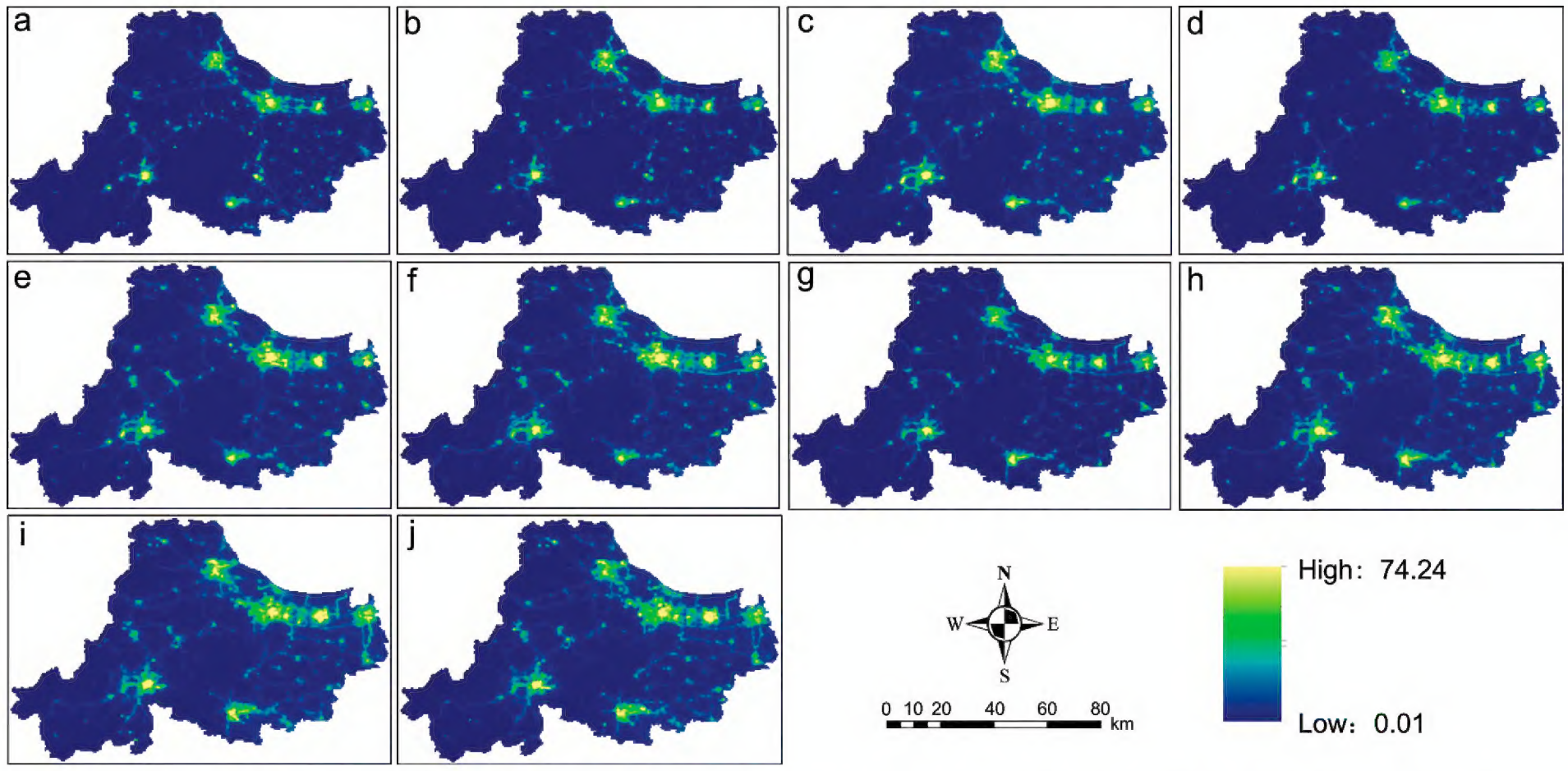


**Figure 2.** Changes of nighttime light data of Huzhou, 2012–2021. a-j represent the annual data distribution of nighttime lights in Huzhou from 2012 to 2021, respectively. Nighttime lighting data well reflects the degree of urbanization, intensity of human activities and the intensity of land development. The nighttime light data obtained from the Resource and Environment Science and Data Center (Xu 2022).

## The concepts and a system of institutions for an ecological civilization in Huzhou of China

A civilization may thrive if its natural surroundings thrive, and will suffer if its natural surroundings suffer (Xi 2019). However, the earth's ecosystem is facing an unprecedented crisis, and the threat to global biodiversity continues to deteriorate, thus limiting global sustainable development. To effectively cope with the crisis, China has actively promoted ecological civilization, continuously enhanced the diversity, stability and sustainability of the ecosystem, and explored a unique road of biodiversity conservation and sustainable development.

Since 2012, China has emphasized ecological civilization as a long-term national strategy to promote sustainable development (Lu et al. 2017; Wu et al.

2019). Building an ecological civilization should focus on the harmonious coexistence between people and nature (Pan 2016; Wu et al. 2019). While human beings transform nature, they should also protect nature, and the harmonious and unified relationship between human and nature should be maintained (Ye 1984). In 2014, Huzhou was listed as the first prefecture-level ecological civilization demonstration zone (National Development and Reform Commission 2014). For more than a decade, Huzhou has always adhered to achieving harmony between people and nature, taking biodiversity conservation and sustainable development as essential components to ensure the progression of building an ecological civilization (Fig. 3). Specifically, Huzhou has promoted regional biodiversity conservation and sustainable development by incorporating the concepts of ecological sustainability and biodiversity conservation into the planning and management of the region's sustainable development. Furthermore, Huzhou has also used naturalness evaluation to guide regional biodiversity conservation and planning management (including strengthening the protection of animal and plant habitats, setting up and preserving biological corridors, etc.).

Sustainable development, being one of the most important development concepts in building an ecological civilization, has set its core goal of realizing the balanced development of ecology, economy and society, and striving to seek the


Method
Effect
Improve policies and regulations, improve the system and set up a leading group
Top-level design
The relevant policy document was issued, and the work direction was clarified
Environmental governance: green development of Yu Village in Anji County
Circular Agriculture Ecosystem: Mulberry Dike-fish pond in Nanxun district
Develop green industry: bamboo ecology and economy in Anji County
Sustainable development
The environment of Yu Village has been significantly improved and has become a world-famous scenic spot
Mulberry Dike-fish pond tourism realizes an annual income of 40 million yuan
Bamboo industry has become a pillar industry in Anji County, and has produced great economic benefits
Ecosystem protection: delineate nature reserves and implement the project of returning farmland to forests
Species conservation: such as in-situ conservation, ex-situ conservation and breeding techniques
Biodiversity conservation
The forest coverage rate in Huzhou reached 48.23%, and the habitat quality was significantly improved
The population recovery of Chinese alligator, Crested ibis and Anji salamander was realized
Establish the implementation alliance of "Kunming-Montreal framework" around Taihu Lake
Carry out the selection of provincial and municipal biodiversity experiences
Hold a series of theme activities to help people and nature coexist harmoniously
Publicity and communication
Strengthened cross-regional exchanges and cooperation and ecological protection coordination
Broaden the channels of public participation and also promote the mainstream of biodiversity conservation
Effectively raised the awareness of public participation in the construction of ecological civilization
Building A Global-oriented Ecological Civilization: Huzhou's Actions and Practice, China
Replicable and scalable experience
Strengthen the top-level design and systematically plan the protection blueprint
Relying on rich resources, accelerate the transformation of ecological value
Delineate nature reserves and carry out habitat protection and restoration
Strengthen cooperation and exchange, and enhance public participation awareness

**Figure 3.** The framework of building an ecological civilization in Huzhou: method, effect and experience.

harmonious unity between maximizing the benefits from resource utilization and development and minimizing the impacts on natural environment. In addition, biodiversity conservation is intrinsically linked to the United Nations (UN) 2030 Sustainable Development Goals (SDGs), such as poverty reduction, food security and combating climate change. Therefore, protecting biodiversity also means promoting sustainable development. Simultaneously, biodiversity conservation is essential for the global realization of sustainable development goals. As an important foundation and carrier of enhancing ecological conservation (Yu 2022), biodiversity is an important evaluation index to measure the degree of developing ecological civilization (Ren and Guo 2021), and it plays an irreplaceable role in building an ecological civilization (Wang et al. 2020). Hence, scientific and effective biodiversity conservation needs to be carried out under the concept and framework of building an ecological civilization. In addition, to a great extent, the development of ecological civilization needs to be continuously promoted through biodiversity conservation and sustainable utilization (Fig. 4). Therefore, there is an inseparable internal relationship between biodiversity conservation and building an ecological civilization. Generally speaking, coordinating the concept and system of the harmonious development of people and nature is one of the important prerequisites for the success of building an ecological civilization in Huzhou.

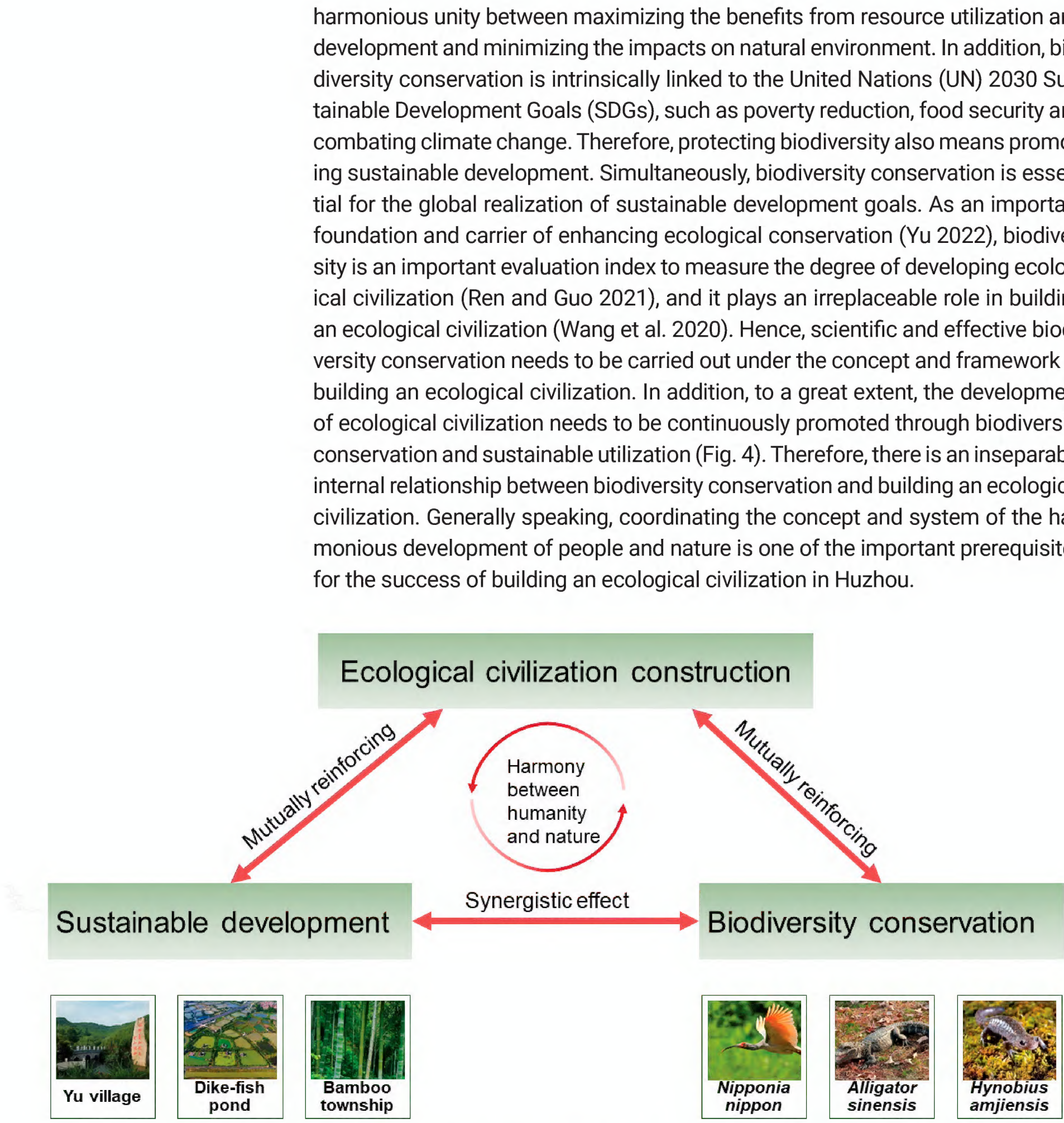


**Figure 4.** Sustainable development and biodiversity conservation promote the process of building an ecological civilization in Huzhou. In addition, typical cases of sustainable development include: green development of Yu Village in Anji County, Mulberry Dike-Fish Pond System in Nanxun district, bamboo ecology and bamboo economy in Anji County. Furthermore, typical cases of biodiversity conservation include: the population of *Nipponia nippon* in Deqing County, *Alligator sinensis* in Changxing County and *Hynobius amjiensis* in Anji County increased steadily.

## Adhere to the priority of conserving resources, protection and natural recovery

In terms of resource conservation, Huzhou always adheres to green technology innovation and development (Ministry of Science and Technology of the People's Republic of China 2021), improves resource utilization, and reduces the discharge of production wastes. For example, the comprehensive utilization

rate of crop straw in Huzhou has reached 97.49% (People's Daily Online 2022). In addition, Huzhou actively promotes the reform of the supply-side structure (Huzhou People's Government 2017), improves product quality, and extends product life. In the meantime, Huzhou also advocates that residents should keep a healthy lifestyle, prompt thrift and frugality, and reduce municipal solid waste (MSW) and waste discharge. For example, in 2021, the total amount of household waste in Huzhou was reduced by 3% compared to the previous year, and the recycling rate in urban and rural areas exceeded 60% (Huzhou People's Government 2022b). In terms of protection priority and natural restoration, Huzhou adheres to the concept of green development, strictly abides by the red line of ecological environment protection, leaving enough space and time for natural restoration. In addition, Huzhou insists on natural restoration, supplemented by artificial treatment, and changes post-treatment to pre-protection. In the process of construction and development, Huzhou has prioritized environmental protection, continuously strengthened the protection of forest resources, continuously promoted "land greening action", and increased the forest coverage area. By 2022, the forest coverage rate of Huzhou had reached 48.23% (Huzhou People's Government 2022c), achieving full coverage of provincial forest cities and towns, ranking the top in Zhejiang Province (Department of Forestry of Zhejiang Province 2022).

### Establish a leading group for building an ecological civilization

To strengthen the overall planning and coordination of building an ecological civilization, Huzhou has set up the leading group office to carry out the substantive operations and promote the reform and innovation of building an ecological civilization. The leading group is headed by the main leaders of the municipal party committee and government, and regularly schedules the progress of projects for developing ecological civilization. In addition, Huzhou has also issued supporting measures to investigate the responsibility of government leaders for ecological environment damage, and to further strengthening the leadership's responsibility for the protection of ecological environment and resources.

### Develop a system of institutions for an ecological civilization

Huzhou advocates the conservation and sustainable use of biodiversity in the whole process of building an ecological civilization, and actively promotes biodiversity conservation as a significant component of economic and social development planning. Furthermore, Huzhou also insists on taking the natural carrying capacity as the basis, accelerates the formation of green development model, advocates green and low-carbon life, and jointly promotes high-quality development and high-level biodiversity conservation. In terms of system development, Huzhou has successively issued a series of local policies and regulations, including the "Regulations on Building an Ecological Civilization Pilot Demonstration Zone in Huzhou" (Huzhou People's Government 2016), the "Action Plan for Ecological Restoration and Biodiversity Conservation of Important Water Systems in Huzhou (2021–2025)" (Huzhou People's Government 2022d) the "Implementation Opinions on Financial Support for Biodiversity Conservation" (Huzhou People's Government 2022e), and the "Action Plan for

Comprehensively Strengthening Biodiversity Conservation (2022–2025)". In addition, Huzhou has also completed the preparation of the "Specification for Evaluation of Biodiversity Conservation and Sustainable Development Base". The introduction of a series of policies will help to promote the mainstreaming of biodiversity conservation in Huzhou, and meanwhile, will help to promote people's deeper understanding and participation in developing an ecological civilization. However, there are also various problems such as the disconnection between environmental policies and regional economic development policies. Hence, the complementarity and coordination between various environmental policies need to be strengthened. In this regard, Huzhou officially released the "Regulations on Promoting the Construction of Ecological Civilization Model City in Huzhou" on April 19, 2024 and it will be formally implemented on May 1, 2024. This regulation makes clear provisions for green low-carbon development, ecological protection and restoration, and the realization of the value of ecological products. It is worth noting that this regulation is also the first one in China to promote the construction of an ecological civilization model city.

## Actions and effects of sustainable development in Huzhou

Huzhou plays an important role in ecological protection and ecological barrier in Taihu Lake Basin and Yangtze River Delta of China. Ecological advantage is the biggest advantage of Huzhou and also the most valuable resource of Huzhou. As a leading demonstration zone for building an ecological civilization in China, Huzhou has always adhered to the principle of the unity of biodiversity conservation and economic and social development, and has achieved remarkable results. In addition, Huzhou has also given full play to its own ecological advantages and embarked on a path of sustainable development featuring ecological beauty, industrial prosperity and people's wealth. As the first city-level ecological civilization demonstration area in China, Huzhou unswervingly practices the concept that "Lucid waters and lush mountains are invaluable assets", and deeply implements the strategy of "ecological poverty alleviation". Furthermore, Huzhou has explored a new development path of mutual promotion between economic and social development and ecological environmental protection through various models, such as the development of characteristic biological resources, enterprise cooperation and co-construction, and cooperative trusteeship and sharing. Next, we will introduce three typical successful cases in the process of building an ecological civilization in Huzhou, and also show the world the beauty of green mountains, clean waters and the road of ecological prosperity.

### Environmental governance: Green development of Yu Village in Anji County

Yu Village is a small mountain village in Anji County of Huzhou City, which is located in the northern mountain area of Zhejiang Province (Zhang et al. 2021). This is the earliest practical sample of beautiful rural construction in China, and also one of the earliest areas in Zhejiang to develop "farmhouse enjoyment". However, before 2005, Yu Village was mainly engaged in limestone mining (Zhang et al. 2021). Although the annual net income of the village was more than 1–2 million Yuan, the ecological environment had been seriously damaged.

Sand and stones flew over the bamboo forest, and the water in the river turned into white mud. From bitter experience, the villagers of Yu Village decided to close the hillsides for afforestation and environmental protection. In 2003, Zhejiang Province started the project of "Demonstration of Thousands of Villages and Renovation of Ten Thousand Villages" in the whole province, which promoted the construction of rural living environment involving tens of millions of farmers. Since then, the industrial development of Yu Village has undergone a transformation. From 2003 to 2005, the village closed mines and cement plants in succession, began to change its development path, unswervingly practiced the concept that "Lucid waters and lush mountains are invaluable assets", and integrated the concept of building an ecological civilization into the reform and development of small towns (Zhang et al. 2021). In the past 20 years, villagers have been committed to protecting green mountains and clean waters.

Through the construction of scenic spots, the development of homestays, farmhouses, and other tourism projects, Yu Village has established a new era of rural governance model and promoted the overall revitalization of the countryside. Ultimately, Yu Village in Anji County has changed from a village with serious ecological damage and environmental pollution to a beautiful village (Fig. 5), surrounded by green mountains and dense forests. It is reported that in 2022, the annual village collective economic income of Yu Village reached 13.05 million Yuan, the per capita net income of 64,000 Yuan, and the operating income exceeded 8 million yuan (People's Daily Online 2023), which has been greatly improved compared with 20 years ago. At present, Yu Village has been recognized by the United Nations World Tourism Organization (UNWTO) as one of the world's best tourist villages and has become a world-famous scenic spot (Fig. 5).

**Figure 5.** The comparison between Yu Village's past and present. (Left) The ecological environment is seriously damaged and the air quality is poor. (Right) Beautiful scenery and excellent ecological environment.

## Circular agriculture ecosystem: Mulberry Dike-Fish Pond System in Nanxun district

Huzhou, located in the south of China, has an important agricultural cultural heritage and a typical ecological breeding mode of agricultural circular economy (Wang et al. 2018). In November, 2017, Huzhou Nanxun's "Mulberry Dike-Fish Pond System" was officially recognized as one of the Globally Important Agricultural Heritage Systems (GIAHS) by the Food and Agriculture Organization of the United Nations (FAO) (FAO 2017a). The Mulberry Dike-Fish Pond System is located in the west of Nanxun District, with a total area of about 6,900 hectares. It originated more than 2,500 years ago in the Spring and Autumn

Period and the Warring States Period (FAO 2017b). As an important agricultural cultural heritage and a typical ecological breeding mode of agricultural circular economy in China, it makes full use of the land and creates a composite agricultural production model. By combining mulberry planting, sericulture and fish farming, a mode of digging ponds for fish farming has been created, which uses pond sludge to fertilize mulberry, sericulture with mulberry leaves, feed fish with silkworm feces, and recycle agricultural ecosystem (FAO 2017b; Wang et al. 2018) (Fig. 6). In order to promote the better inheritance and utilization of traditional farming culture in green and high-quality development, Huzhou has always followed the principle of "protection priority, appropriate utilization, multi-participation, and benefit sharing", based on farming culture and ecological agriculture, combined the protection and development of "Mulberry Dike-Fish Pond System" with modern agricultural development, and assisted the construction of beautiful countryside and the building of an ecological civilization. Through the restoration and protection of Nanxun's original ecological "Mulberry Dike-Fish Pond System", it has become a new way for traditional aquaculture to develop in depth, promoting villagers to increase income and becoming a new tourist attraction (Fig. 6). In recent years, the Mulberry Dike-Fish Pond System has gradually become an important brand and a new tourist attraction of rural tourism in Huzhou. It can receive more than 1 million tourists and realize about 40 million Yuan of tourism income each year, leading the villagers to the road of ecological prosperity and common prosperity (Fig. 6).

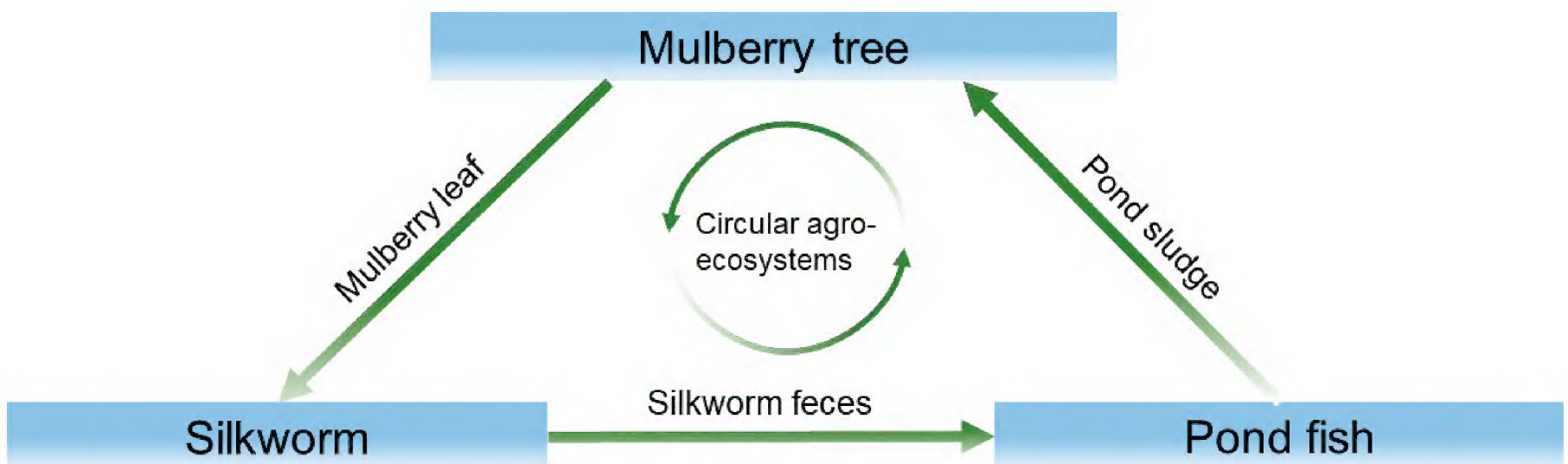


**Figure 6.** A schematic diagram of ecological cycle of Mulberry Dike-Fish Pond System in Huzhou.

## Develop green industry: Bamboo ecology and bamboo economy in Anji County

Anji has a high-quality and beautiful ecological environment, for instance, 75% of the county's land is covered by forest. In addition, it has been considered as a model for achieving sustainable rural development through the bamboo industry (Flynn et al. 2017). There are more than 500 wild bamboo species in China, and more than 360 in Anji County, which is home to the largest bamboo variety in the world (Department of Forestry of Zhejiang Province 2020). In addition, there are 179 species of monopod bamboo, accounting for 71.6% of the total number of its species in the world (Flynn et al. 2017). The existing bamboo forest area of Anji is about 674 $km^2$ (Huang et al. 2022), accounting for 36% of the total area of Anji County (1886 $km^2$). Anji is rich in bamboo production, ranking first in China. In addition, the Bamboo Hometown National Forest Park is also

located in Anji County, with a total area of 114.56 km$^2$ (Wang et al. 2022). Based on this, Anji relies on bamboo resources to promote the sustainable development of bamboo industry. Furthermore, Anji has also taken appropriate management interventions (such as improving the drought resistance of bamboo forests) to carry out ecological management of bamboo forests, maintain the health of bamboo forests, and promote the scientific utilization and ecological recovery of bamboo resources, which is of great significance for ensuring the ecological security and sustainable economic development of bamboo forests. Anji County adheres to the principle of industrial integration and green development, gives full play to its industrial advantages, takes into account the ecological, social, and economic benefits of the bamboo industry, and constantly promotes the development of bamboo tourism towards globalization, uniqueness, and high-quality, so as to maximize the value of ecological advantages. Furthermore, taking advantage of the bamboo industry, Anji has also vigorously developed various derivative industries (such as food, beverages, handicrafts, etc.) to form more than 700 varieties of products (Chen et al. 2011). In addition, Anji has also taken beautiful countryside of China as a big platform for the development of "bamboo tourism", which has promoted the integrated development of the bamboo industry and other industries, and truly achieved the goal of increasing income with bamboo. Specifically, nearly 60% of Anji's revenues come directly from the bamboo industry (Flynn et al. 2017). In addition, Anji has also innovatively promoted the reform of "bamboo forest carbon sink", opened up the channels of bamboo forest carbon sink from production to collection, storage and trading, and realized that the carbon sink can be measured, mortgaged, traded and realized. At present, the bamboo industry has become a pillar industry and a key economic growth point in Anji (Chen et al. 2011). Therefore, the fast-growing bamboo not only opens a new path for Anji, but also finds a good balance between ecological civilization and economic development (Fig. 7).

**Figure 7.** Bamboo landscape and bamboo products of Anji Bamboo Township. (Left) Bamboo forest landscape and footpath. (Right) bamboo handicrafts.

## Actions and effects of biodiversity conservation in Huzhou

Biodiversity is not only the basis of human survival and development, but also the blood and foundation of the life community on earth. Moreover, biodiversity conservation is one of the core issues of the United Nations Sustainable Development Goals (SDGs) (Reyers and Selig 2020). In 2020, Chinese State Council approved the construction of an innovation demonstration zone for the National Sustainable Development Agenda in Huzhou, aiming to provide practical

experience for the implementation of the 2030 Agenda for Sustainable Development (State Council of the People's Republic of China 2022a, b). Biodiversity conservation is necessary for realizing China's new concept of an ecological civilization (Lu et al. 2017; Wu et al. 2019). Accordingly, Huzhou has always adhered to the principle of giving priority to protection and natural restoration, and followed the laws of nature. In order to achieve the goal of promoting the formation of a new pattern of harmonious coexistence between people and nature, Huzhou has also actively explored natural-based solutions (Nbs) to avoid excessive human intervention, effectively protected important ecosystems, biological species and genetic resources, and striven to be at the forefront of biodiversity conservation in the country and even in the world. For the past few years, Huzhou has continued to promote the construction of "Forest Huzhou", actively carried out land greening actions, and made efforts to improve the forest stock and forest "carbon fixation" capacity. By 2022, the forest coverage rate of Huzhou had reached 47.55%, and two national forest parks have been built. In addition, Huzhou also attaches great importance to strengthening the construction and management of nature reserves. At present, two national nature reserves and three national wetland parks have been built, with a wetland protection rate of more than 54%. As of 2022, there are more than 2,200 species of wild higher plants, nearly 600 species of wild vertebrates and nearly 2,500 species of insects in Huzhou. Furthermore, Huzhou is not only rich in biodiversity resources, but also has many rare and endangered species. In the following, the Crested ibis, Chinese alligator and Anji salamander will be taken as examples to introduce the achievements of Huzhou in protecting these rare and endangered species, hoping to provide reference and inspiration for global biodiversity conservation.

## *Ex-situ* conservation: Population reconstruction of Crested ibis

Crested ibis (*Nipponia nippon*) is a globally endangered (EN) bird, endemic to East Asia, and a national key protected wild animal (National Forestry and Grassland Administration and Ministry of Agriculture and Rural Affairs 2021; IUCN 2023) (Fig. 8). Due to the loss of habitat, the wild Crested ibis was seriously endangered and almost extinct in the mid-20$^{th}$ century. In 1981, the last seven Crested ibis in the world were found in Yangxian County of Shaanxi Province. Meanwhile, Huzhou was once the home of Crested ibis, but environmental degradation and habitat destruction led to the extinction of Crested ibis in the late 1950s. In order to rebuild the wild Crested ibis population, at the end of 2007, the Crested ibis group reconstruction and wild release project applied by Deqing County was declared to be approved. In addition, the Xiazhuhu National Wetland Park in Deqing County has been selected as a conservation area for crested ibis due to its unique ecological environment. By taking manual assistance measures and conducting physiological research, the problem of the low fertilization rate was solved well, and the environmental adaptability and reproduction ability of Crested ibis were finally improved. Based on the latest monitoring data, the population size of Crested ibis in Deqing of Huzhou has increased from five pairs in 2008 to 669 individuals in 2022, including 287 wild individuals (National Forestry and Grassland Administration 2022).

**Figure 8.** Crested ibis were released to the wild.

## *In-situ* conservation: Population reconstruction of Chinese alligator

Chinese alligator (*Alligator sinensis*) is a critically endangered (CR) species, and a national key protected wild animal (National Forestry and Grassland Administration and Ministry of Agriculture and Rural Affairs 2021; IUCN 2023) (Fig. 9). Chinese alligators were once distributed in vast areas of China (Wang et al. 2021). However, due to climate change, human hunting and habitat destruction, the number of Chinese alligators has decreased sharply (Wang et al. 2021). At present, they are only distributed in the middle and lower reaches of the Yangtze River. Most of them live in Changxing Chinese Alligator Provincial Nature Reserve and Anhui Chinese Alligator National Nature Reserve. In 1979, Yinjiabian Chinese Alligator Nature Reserve was established in Changxing and upgraded to a provincial nature reserve in 2007. Since then, the reserve has also carried out a lot of scientific research and practical work on the breeding and conservation of Chinese alligators. In order to ensure the reproduction of the Chinese alligator population, there were three major problems in the early stage of the establishment of the reserve: (i) Adult Chinese alligators swallowed dozens of young crocodiles at one time when they are hungry; (ii) The winter cold resulted in a survival rate of hibernating young crocodiles of only about 30%; (iii) Fierce fighting among adult Chinese alligators often led to the death of young crocodiles by crushing their eggs. Therefore, the reserve actively raised funds, built breeding ponds, adult ponds, sub-adult ponds and overwintering ponds for young crocodiles, and purchased and completed the electronic chip marking of adult Chinese alligators, so that managers could accurately record the reproductive behavior of females and males. After more than 40 years of development, the number of Chinese alligators has increased from 11 in early 1979 to more than 9,000 in the reserve (Xinhuanet Zhejiang 2022).

**Figure 9.** Chinese alligator in the Yinjiabian Chinese Alligator Provincial Nature Reserve in Changxing, Zhejiang province.

### *In-situ* conservation: Population increase of Anji salamander

Anji salamander (*Hynobius amjiensis*) is a globally endangered (EN) species. This species is an amphibian unique to China and also a national key protected wild animal (Fig. 10). Anji salamander is mainly found in the peat layer under the cover of alpine *Sphagnum palustre* at altitudes above 1300 m (Yu et al. 2022). In recent years, due to the deterioration of the ecological environment, global warming, increased human interference and other reasons, the living space of Anji salamander is gradually shrinking. In addition, their population renewal ability is relatively weak, and their population continuity is faced with huge survival pressure, even putting it on the verge of extinction. Based on the Longwangshan Provincial Nature Reserve established in 1985 (mainly for protecting deciduous broad-leaved forest), the Anji National Nature Reserve for Salamanders was officially established in 2017, focusing on the protection of Anji salamander, while protecting other rare and endangered animals and plants (such as *Muntiacus crinifrons*, *Neofelis nebulosi*, and *Shaniodendron subaequale*). By constructing artificial breeding population, monitoring and protecting the survival and breeding habitat, the population of Anji salamander has been restored. Anji salamander was first discovered in 1992. The wild population and survival rate of Anji salamander have increased in recent years due to conservation efforts. The latest monitoring data shows that today, after 30 years of protection, their wild population has exceeded 500 (China Central Television 2022). In addition, their survival rate has increased from less than 5% 20 years ago to 70% now (China Network 2022).

**Figure 10.** Anji salamander and its artificial simulated habitat.

## Publicity and communication practice of building an ecological civilization in Huzhou City

### Strengthen cooperation and exchange: establish the implementation alliance of "Kunming-Montreal framework" around Taihu Lake

Huzhou took the opportunity of building an "International Cooperation Demonstration Zone of Ecological Civilization", and actively established the implementation alliance of "Kunming-Montreal framework" around Taihu Lake (Fig. 11). This also indicates that the four cities around Taihu Lake (Huzhou, Wuxi, Suzhou and Changzhou) will make concerted efforts to jointly protect and govern the area, and jointly draw a beautiful picture of the harmonious coexistence of man and nature around Taihu Lake. In addition, Huzhou officially established the Huzhou Center of Biodiversity Conservation in 2023, and actively carried out international exchanges, brand communication, personnel training, etc., with a view to telling the international community a good story about building an ecological civilization.

### Promote the construction and selection of biodiversity experience site

In order to build a demonstration window for biodiversity conservation, Huzhou fully taps local characteristic resources, actively builds a unique biodiversity experience site and a natural education base, and highlights the diversified functions of the base such as ecological protection and popular science education (Fig. 11). Up to now, Huzhou has selected 2 provincial and 16 municipal biodiversity experience sites, which is of great significance for broadening public participation channels and promoting the building of ecological civilization.

### Hold a series of thematic publicity activities

In order to strengthen the publicity of biodiversity to the public, Huzhou has made full use of “International Biodiversity Day”, “World Environment Day”, and “National Ecological Day” to carry out thematic activities such as popular science lectures as well as publicity and education (Fig. 11), so as to unblock the ways and channels for the public to obtain knowledge related to ecological civilization, and improve the awareness and enthusiasm of the public for participating in building an ecological civilization.

**Figure 11.** Publicity activities held by Huzhou in the process of building an ecological civilization. (Upper left) The practical alliance of “Kunming-Montreal framework” around Taihu Lake was established. (Lower left) Theme activities of “International Biodiversity Day”. (Right) Popular science education activities in biodiversity experience areas.

## Enlightenment and summary of building an ecological civilization in Huzhou City

### Insights into how other cities achieve the same goal

Currently, human beings are facing many global ecological problems such as climate change, biodiversity loss, and environmental pollution, which pose serious challenges to human survival and development. In the context of the United Nations Sustainable Development Goals (SDGs), Huzhou has made significant

contributions to global biodiversity conservation and green sustainable development through a series of ecological civilization building activities. Specifically, Huzhou has carried out a series of specific actions, such as launching the bamboo forest carbon sink reform, exploring Gross Ecosystem Product (GEP) accounting and standardizing the operation of the "two mountains" cooperative (Huzhou People's Government 2023). These activities will help to improve global biodiversity conservation, promote green development and realize the United Nations Sustainable Development Goals (SDGs). There is no doubt that the case and method of building an ecological civilization in Huzhou can provide profound insights for other cities to achieve the same goal.

The case study of Huzhou we have chosen promotes the ecological civilization and sustainable development globally through practical actions such as green and low-carbon development, resource recycling, and biodiversity conservation. The reason why Huzhou has made many achievements in ecological civilization and sustainable development is due to top-level design and policy support, which has resolved the contradiction between ecological environmental protection and economic development well (Fig. 3). If other regions in the world want to achieve green and sustainable development like Huzhou, it is very important for the government to formulate a top-level design that is actively suitable for local development and promote its implementation. In addition to the guidance of government departments, it is also very important to improve public awareness and participation and enhance their ecological conscience (Trochet and Schmeller 2013). In addition, Huzhou abides by nature's laws, explores solutions predicated on protecting nature, and avoid excessive human intervention in nature. According to the data released by Huzhou Natural Resources and Planning Bureau in 2023, the area of nature reserves in Huzhou currently accounts for more than 5.7% of the city's land area. Therefore, actively delineating nature reserves and carrying out habitat protection and restoration are also among the ways to replicate the successful experience of Huzhou. In this regard, the integration of biodiversity conservation in spatial planning will provide more basis for the green development of cities, and will also be beneficial to urban planners in other cities in China and around the world. Finally, while actively relying on existing resources to transform ecological value, other cities also need to promote rational use of resources and reduce waste, and improve public awareness and participation, which also plays a very important role in promoting the construction of ecological civilization to achieve sustainable development. Significantly, Huzhou has always prioritized environmental conservation and restoration of nature. Therefore, for Chinese and global policy makers, it is important to change their mindset, actively transform ecological advantages into development advantages, and promote the development of the green energy industry through "government-enterprise cooperation" to promote a virtuous cycle of conservation and development.

## Mission and responsibility of Huzhou in the new era

In recent years, Huzhou has achieved remarkable results in the process of building an ecological civilization and biodiversity conservation. This time, Huzhou was recognized by COP15 as the "International Cooperation Demonstration Zone of Building an Ecological Civilization", which also gave Huzhou a new

mission and task. The Kunming-Montreal Global Biodiversity Framework, adopted during the second phase of COP15, proposed to promote sustainable development and protect biodiversity as the core objectives. Biodiversity conservation is not only an important part of building an ecological civilization, but also related to the survival, development, and future of human beings. In the next step, under the guidance of the Ministry of Ecology and Environment, Huzhou will closely communicate with the secretariat of the United Nations Convention on Biological Diversity, to study and formulate future-oriented local action plans for biodiversity conservation and ecological civilization around the implementation of the Post-2020 Global Biodiversity Framework. To be more specific, Huzhou will continue to increase the protection of important ecosystems, species and biogenetic resources in the future, and strive to create a new pattern of harmonious coexistence between humans and nature. In addition, Huzhou will also strive to build a world-renowned demonstration zone for international cooperation in ecological civilization, and strive to explore the best cases and demonstration samples for the systematic protection and utilization of biodiversity.

The Kunming-Montreal Global Biodiversity Framework notes that achieving the global targets of sustainable development and biodiversity conservation by 2030 requires concerted actions and cooperation between governments. Therefore, it is necessary to strengthen international exchanges and cooperation and constantly promote the improvement of institutional mechanisms. In the future, Huzhou will also draw a blueprint for its future from the perspective of building an ecological civilization and the harmonious coexistence between human and nature, actively carry out global action, global response and global cooperation, and promote the improvement of a fair, reasonable and win-win global biodiversity governance system. Furthermore, Huzhou will also continue to follow the sustainable development path of ecological beauty, green industry and prosperity of the world. In addition, Huzhou should not only promote the green transformation of its own economic and social development, but also actively contribute to the global low-carbon transformation and contribute successful experience to the green development of the world. Specifically, Huzhou will further increase exploration and practice, and strive to form more learnable, replicable and promotable Huzhou experience in the aspects of institutional mechanism innovation, pilot demonstration construction, standard application and promotion, etc., and make efforts to create a number of replicable green development demonstration cases for China and the world. Generally speaking, Huzhou will always be committed to making greater contributions to the joint construction of a community of the earth's life and a clean and beautiful world, and strive to realize the beautiful vision of coexistence between human and nature.

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## Additional information

### Conflict of interest

The authors have declared that no competing interests exist.

## Ethical statement

No ethical statement was reported.

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## Author contributions

Conceptualization, P.Y. and J.W, investigation, P.Y. and J.W, data curation, P.Y. and J.W, writing—original draft preparation, P.Y, writing—review and editing, P.Y. and X.Z, visualization, P.Y. and X.Z, supervision, J.W, project administration, J.W, funding acquisition, J.W. All authors have read and agreed to the published version of the manuscript.

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## Data availability

All of the data that support the findings of this study are available in the main text.

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